DESCRIPTION OF THE SPECIFIC EMBODIMENTS

Microchannels having at least an acrylic inner surface and their use in electrophoretic applications are provided. The microchannels have a variety of cross-sectional configurations, where the channels have micro scale cross-sectional inner dimensions. The subject microchannels give rise to substantially reduced EOF and/or sample component adsorption under conditions of electrophoresis, as compared with native or untreated fused silica, and are therefore suited for a variety of different electrophoretic applications.

The microchannels of the subject invention may be open or closed, where by "open" is meant that the internal volume of the microchannel is not completely separated on at least one longitudinal side from the external environment, while by "closed" is meant that the internal volume of the channel is completely separated longitudinally from the external environment. Examples of open microchannels include troughs, trenches and the like, while closed channels are exemplified by cylinders, tubes, capillaries and the like. The subject microchannels will have microscale cross-sectional inner dimensions, such that the inner cross-sectional dimensions of the microchannels will be greater than 1 μm and less than 1000 μm. Generally, the cross-sectional inner dimension(s) of the microchannel, i.e. width, depth or diameter depending on the particular nature of the channel, will generally range from about 1 to 200 μm, usually from about 10 to 150 μm, more usually from about 20 to 100 μm, with the total inner cross sectional area of the microchannel ranging from about 100 to 40000 μm^2, usually from about 400 to 25,000 μm^2. The inner cross-sectional shape of the microchannel may vary among a number of different configurations, including rectangular, square, rhombic, triangular or V-shaped, circular, semicircular, ellipsoid and the like. The length of the microchannel will necessarily depend on the specific nature of the vessel as well as the electrophoretic device in which it is to be employed. For example, where the microchannel is a trough or trench in a substrate, the length of the microchannel may range from about 0.1 to 100 cm, and will generally range from about 1 to 20 cm, usually from about 1 to 10 cm, and more usually from about 5 to 10 cm, while for capillaries the length will generally range from about 10 to 100 cm, usually from about 10 to 75 cm, more usually from about 20 to 50 cm. Where the subject microvessel is contained within a capillary, the thickness of the wall of the capillary may range from about 50 to 1000 μm, usually from about 100 to 500 μm, more usually from 100 to 150 μm, to provide a capillary with an outer diameter ranging from 100 to 2000 μm, usually from about 150 to 400 μm.

In the subject movement area or microchannels, at least the inner surface defining the microchannel will be an acrylic polymer material. By "at least the inner surface" is meant that anywhere from a portion to the entire wall(s) of the microchannel may be an acrylic polymer material, where when only a portion of the microchannel is an acrylic polymer material, that portion will be the inner portion of the channel wall that is immediately adjacent to the electrophoretic medium present in the channel during electrophoresis. Thus, the entire microchannel may be fabricated from the acrylic polymer material, or the inner surface of the microchannel may be coated with a thin acrylic polymer layer. Generally, the thickness of the acrylic portion of the microchannel will be at least about 1 μm, usually at least about 10 μm, more usually at least about 25 μm, and may be several mm or higher, but will usually not exceed 10 mm, and more usually will not exceed 5 mm.

Where only the inner portion defining the microchannel is an acrylic polymer material, the remainder of the channel wall may be any convenient material, including a heat dissipating material which serves to absorb heat produced in the electrophoretic medium during electrophoresis. Thus, where the microchannel is on the surface of an acrylic substrate, e.g. a trench or trough, the substrate may be a composite substrate comprising a layer of acrylic polymer over a heat dissipating material. For capillaries, the acrylic inner surface, i.e. inner tubular section, of the capillary may be surrounded or coated with a layer or outer tubular section of heat dissipating material, where the outer layer or coating of absorbent material may be partially removed as necessary to expose the inner acrylic portion of the capillary wall when on-line detection is desired. Specific materials which provide for heat dissipation and may make up at least a portion of the microchannels include glasses, ceramics, metals and the like. Specific heat absorbent materials of interest, depending on the nature of the microchannel, include aluminum, copper, glass and the like. In use, the metals would be removed or insulated from contact with any conductive mediums to prevent a short circuit.

As mentioned above, microchannels according to the subject invention have a variety of different configurations, including trenches or troughs on or at the surface of a substrate, capillaries, and other microscale configurations suitable for holding or containing an electrophoretic medium during electrophoresis. Where the microchannel in device **9** is a trench or trough extending downward from the surface of a substrate, conveniently a groove **11** in a body or substrate **12** of an acrylic material of the type disclosed herein, as shown in FIG. **2**, the substrate may be square, rectangular, circular and the like, and will have dimensions which will vary considerably depending on the intended use of the microchannel, with a card-like or substantially regular parallelepiped dimensioned substrate being of particular interest. Where the substrate has card-like or substantially regular parallelepiped dimensions, the length of the substrate will typically range from about 2 to 200 mm, the width of the substrate will typically range from about 2 to 200 mm, while the thickness of the substrate will typically range from about 0.1 to 10 mm. One or more, usually at least 2 and up to 100 or more, microchannels may be present on or at the surface of the substrate, where when a plurality of microchannels are present at the substrate surface, the possibility exists to have a number of different electrophoretic applications running at the same time on a single substrate. The microchannel(s) present on the substrate surface can be linear, branched or in some other convenient configuration. With branched microchannels or trenches, the possibility exists to have a first trench or channel intersected by one or more side channels, where the side channels may intersect the main channel at any convenient angle.

As the microchannel(s) present on the substrate surface may be open, it may be desirable to separate the internal volume of the channel, and thereby the medium housed in the channel, from the external environment. In such instances a cover plate **13** can be employed which rests on the surface of the substrate and thereby separates the internal volume of the channel from the environment. The cover plate may be fabricated from a number of different materials, including fused silica, acrylic polymeric materials, and the like. Where necessary, one or more of the cover plate surfaces may be treated to reduce any EOF that may arise during electrophoresis. The necessity for treatment, as well as the specific type of treatment, will necessarily depend on the particular material employed as the cover plate. For